1989

Distribution, Growth and Survival of Head Started, Tagged and Released Kemp's Ridley Sea Turtles (*Lepidochelys kempi*) from Year-Classes 1978-1983

Clark T. Fontaine, Sharon A. Manzella, Theodore D. Williams, Richard M. Harris and William J. Browning*

A cooperative program between the United States and Mexico was initiated in 1978 in an effort to save the Kemp's ridley sea turtle (Lepidochelys kempi) *from extinction. Participating agencies include the Instituto Nacional de la Pesca of Mexico, National Marine Fisheries Service, U.S. Fish and Wildlife Service, National Park Service and Texas Parks and Wildlife Department.*

Part of the cooperative program includes an experiment in head starting Kemp's ridleys to increase their survival during the first year of life in captivity and to establish a new nesting colony on Padre Island, near Corpus Christi, Tex. The head start research project involves removing eggs from the nesting beach at Rancho Nuevo, Mexico, hatching the eggs and imprinting the hatchlings at Padre Island, rearing the hatchlings to yearlings at Galveston, Tex., then releasing the tagged yearlings into the Gulf of Mexico. This paper discusses the releases and recaptures of the 1978 to 1983 year-classes of head started Kemp's ridleys as of September 30, 1985.

By the end of September 1985, 8,241 head started and tagged Kemp's ridleys had been released, and there had been 399 reported recoveries. Included were reports from the east coast of Mexico, the coast of the northern half of the Gulf of Mexico, the east coast of the United States as far north as New York, and from France and Morocco.

Growth of the released Kemp's ridleys was slower than that of Kemp's ridleys of the same ages held in captivity. Head started turtles survived and grew well after release, though those recovered in the Atlantic Ocean grew slower than those recovered in the Gulf of Mexico. Further, when recovery data were compared to the historical distribution of Kemp's ridleys as reported in the literature and by the Sea Turtle Stranding and Salvage Network, Archie Carr's speculation about a northern West Africa nesting site was resurrected.

The Kemp's ridley sea turtle (*Lepidochelys kempi*) is listed as endangered under the United States Endangered Species Act of 1973. In 1978, a multiagency, cooperative, conservation effort was initiated by the Instituto Nacional de la Pesca (INP) of Mexico, the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), the National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD) to work toward Kemp's ridley recovery (Klima and McVey, 1982). This program included intensive protection of eggs and turtles at the primary nesting beach near Rancho Nuevo, Tamaulipas, Mexico, and a project whose objective was to establish a second breeding colony at Padre Island National Seashore near Corpus Christi, Tex. The latter project was based on annual translocation of eggs from Rancho Nuevo to the National Seashore, incubating them there, imprinting the hatchlings to Padre Island beach and surf, then head starting the hatchlings at the NMFS Southeast Fisheries Center's (SEFC) Galveston Laboratory (Anonymous, 1978; Wauer, 1978; Klima and McVey, 1982; Caillouet, 1984; Fontaine and Caillouet, 1985). Head started Kemp's ridleys were tagged and released into the Gulf of Mexico. This paper reports observations on the distribution, survival and growth of head started and tagged Kemp's ridleys from year-classes 1978 to 1983. Manzella, Caillouet and Fontaine (1988) have recently updated the recovery information by including later year-classes.

Materials & Methods

Rearing

During each nesting season beginning in 1978, a small portion (less than 5 percent) of the eggs laid by Kemp's ridley nesters at Rancho Nuevo have been collected by personnel of the INP and FWS and their cooperators and transferred to the Padre Island National Seashore. The eggs were not allowed to touch the Rancho Nuevo sand but were caught in plastic bags then placed in polystyrene foam boxes containing Padre Island sand in hopes of imprinting the eggs

* *National Marine Fisheries Service*

to Padre Island. After incubation of the eggs in boxes within a hatchery at the National Seashore, the hatchlings that emerged were allowed to crawl across the Padre Island beach to enter the surf in hopes of strengthening or reinforcing the imprinting process. NPS personnel then collected the hatchlings with dipnets and put them in boxes to be transported by U.S. Navy or Coast Guard aircraft to the NMFS SEFC head start research facilities in Galveston where they were reared in captivity usually for 10 to 11 months before being released usually offshore of Padre Island. These yearlings had been tagged in several ways before being released into the Gulf of Mexico.

Head start facilities and husbandry methods have been described in detail by Fontaine *et al.* (1985) and Fontaine *et al.* (1989). First-year growth and survival during head starting have been described by Caillouet *et al.* (1986).

Tagging

Usually about 30 days before the annually scheduled release of head started Kemp's ridleys, all yearlings in good health and physical condition are tagged with metal flipper tags. This allows time for observations to be made on tag retention and on possible infection caused by tagging, as well as for appropriate remedial actions. It also allows time for tag-related mortality, if any, to occur before the release.

Flipper tags used on head started turtles (Table 1) were purchased from the National Band and Tag Company and were Hasco type, style 681, self-piercing, self-clinching tags. All tags were monel metal except for inconel tags used on 100 turtles of the 1980 year-class (the latter tags were obtained from George Balazs, NMFS, Southwest Fisheries Center, Honolulu Laboratory). The G- and F-series tags used on the 1978 year-class, and the K-series tags used on the 1980 year-class, were obtained from Dr. Archie Carr, and were inscribed with the message "Reward Primio Remite, Send Dept. Biol., U.F., Gainesville, Fla. U.S.A." The NNA-series through NNQ-series tags, used on the 1979 to 1983 year-classes and on one turtle of the 1978 year-class were inscribed with the message "Send NMFS Lab, Virginia Key, Miami, FL 33149." The 800-series inconel tags from Hawaii were inscribed with the message "Write H.I.M.B. University, Hawaii 96744." Two odd tags, No. 13582 (one turtle of the 1978 year-class) and J0096 (one turtle of the 1979 year-class) were also used.

Flipper tags used on the 1978 to 1981 year-classes were first soaked in gasoline for 24 hours then in 90 percent alcohol for 24 hours prior to use, without apparent problems. Tags used with the 1983 year-class were sterilized by autoclaving. The tags were applied to each turtle using a standard Hasco tag applicator. The area of tag insertion was swabbed with tincture of iodine. Neosporin, a topical antibacterial ointment, was placed on the sharp point of the tag and the tag was inserted on the trailing edge of the right front flipper. Some of the turtles were double-tagged with flipper tags; i.e., a second flipper tag was attached to the left front flipper. The double-tagging was done in hopes of increasing the chances that one of the flipper tags would be retained. However, it was recognized that if each tag had the same probability of loss, then, on the average, both would be lost about the same time. For this reason, additional tag types (internal magnetic tags and living tags) were also used on some year-classes. However, only recapture results for flipper tags are reported herein, because recovery reports from the internal tags and living tags are indeed rare events, as they require special equipment (magnetometer) or expertise to be recognized.

Release weight of each head started turtle was taken at the time of tagging so some growth could have taken place between the time the turtles were tagged and the 30 or 50 days thereafter when they were released. An O'haus "Dial-o-gram" beam balance was used for weighings to the nearest 0.1 gram. Measurements of carapace length and width were also made and were straight line measurements as recommended by Pritchard *et al.* (1983). Measurements were made to the nearest 0.1 cm, initially with a hard plastic rule and later with calipers. Data on length and width measurements are available, but only weights are included in our analyses herein.

Release

Turtles were transported to release sites (Table 1) in cardboard boxes described by Fontaine *et al.* (1985, 1989). All turtles were released in the Gulf of Mexico or in adjacent bays. Most turtles of the 1978 and 1979 year-classes were released in Florida waters, 113 of the 1978 year-class and six of the 1979 year-class were released off Texas and 197 turtles of the 1980 year-class were released from the NOAA research vessel *Oregon II* in the Bay of Campeche, Mexico. All the rest were released in Texas waters, either offshore or inshore. In 1983, 96 of the 1982 year-class turtles were released in Nueces Bay, Tex., part of the Corpus Christi Bay system near the Padre Island National Seashore. Other releases of small groups or individual turtles represented turtles held back from the major releases for a variety of reasons (e.g., due to injuries or illnesses, being too small at times of major releases, or because they were used for potential brood stock). The total tagged turtles released was 8,241, or 79.4 percent of the 10,376 imprinted hatchlings of the 1978 to 1983 year-classes received alive from NPS for head starting (Table 2).

Sources of Recoveries

Reports of head started Kemp's ridleys found in the wild were received by telephone and from correspondence from the public, the Sea Turtle Stranding and Salvage Network, Dr. Archie Carr's office at the University of Florida

Table 1. Summary of imprint groups, release sites, dates of release, numbers of turtles released and tag code series used for head started Kemp's ridley sea turtles of the 1978-1983 year-classes.

Year-class	Imprint group[a]	Release site	Release date Dy/Mn/Yr	No. Released	Tag code series[b]
1978	PINS[a]	Sandy Key, Fla.	22/02/79	135	G——
	PINS	East Cape, Fla.[c]	22/02/79	52	G——
	PINS	East Cape, Fla.	28/02/79	1	13582
	PINS	East Cape, Fla.	28/02/79	166	G——
	PINS	Sandy Key, Fla.	05/03/79	172	G——
	RN	Homosassa, Fla.	08/05/79	751	G——, F——
	PINS	Homosassa, Fla.[c]	08/05/79	628	G——, F——
	PINS	Padre Island, Tex.	07/07/79	112	G——, F——
	RN	Padre Island, Tex.	07/07/79	1	G0985
	PINS	Homosassa, Fla.	03/06/80	1	NNA260
	Subtotal			2,019	
1979	PINS	Homosassa, Fla. (offshore)[c]	03/06/80	665	NNN—
	RN	Homosassa, Fla. (nearshore)	05/06/80	66	NNA—
	PINS	Homosassa, Fla. (nearshore)[c]	05/06/80	608	NNN—, NNA—
	PINS	Padre Island, Tex.	02/06/81	5	K——
	PINS	Galveston, Tex.	28/09/81	1	J0096
	Subtotal			1,345	
1980	PINS	Padre Island, Tex.	02/06/81	1,426	NNB—, K——
	PINS	Padre Island, Tex.	02/06/81	100	8001-8100 (Inconel)
	RN	Campeche, Mexico	03/03/81	197	NNB—, K——
	Subtotal			1,723	
1981	PINS	Padre Island, Tex.	02/06/82	1,521	NNG—, NNH—
	PINS	Sabine Pass, Tex.	14/07/82	118	NNG—, NNH—
	Subtotal			1,639	
1982	PINS	Padre & Mustang Islands	07/06/83	1,159	NNL—, NNM—
	PINS	Nueces Bay, Tex.	07/06/83	96	NNL—, NNM—
	PINS	Sabine Pass, Tex.	15/07/83	69	NNL—, NNM—
	PINS	Mustang Island, Tex.	05/06/84	1	NNM428
	Subtotal			1,325	
1983	PINS	Mustang Island, Tex.	05/06/84	172	NNQ—
	RN	Mustang Island, Tex.	05/06/84	18	NNQ—
	Subtotal			190	
Year-classes Combined					
	RN			1,033	
	PINS			7,208	
Total				8,241	

[a] PINS = imprinted at Padre Island National Seashore, and
RN = imprinted at Rancho Nuevo.
[b] Monel metal tags, unless noted otherwise. Each dash represents three or four numerical digits from 0-9; actual numerical series are not given because they were mixed. Details concerning numerical series can be obtained from Sharon A. Manzella, NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, Tex., 77551.
[c] This release included turtles also tagged with radio-transmitters (see Klima and McVey, 1982; Wibbels, 1984).

and the Endangered Species Program Office, NMFS, SEFC, Miami, Fla. Unfortunately, in many cases, complete information was not available for each recovery.

Results

Recoveries by Year-class

Out of 399 recoveries (Table 2), 88 were excluded from subsequent summary tables and figures. These 88 turtles had been recovered in 10 or fewer days of their release. Therefore we believed such turtles were not representative due to disorientation, weakness, illness or other problems at the time of release. The remaining 311 recoveries included some turtles recovered more than once.

The condition of each turtle as to whether live or dead at recovery is shown by year-class in Table 3. Most (60.8 percent) were reported to have been alive and returned to the environment. Unfortunately, the flipper tags were removed from some of the turtles recaptured alive before they were returned to the water, so they could not be recognized and reported again as tagged turtles if recaptured. For this reason, we recommend that the message on the flipper tags be changed so that the finder clearly understands that it is important to leave the tag affixed to the turtle if it is alive. Several head started turtles whose flipper tags were not removed on first recapture were recaptured on one or more occasions.

Geographic Distribution

Reported recoveries by year-class and state or country indicated diverse geographical distribution (Table 4). The geographical distribution of recoveries was related in part to the release location (Tables 1, 5-7). For example, of the 89 recoveries from turtles released in southern Florida (1,906 from the 1978 year-class and 1,339 from the 1979 year-class) 70 (78.6 percent) were from the Atlantic Ocean, along the eastern coast of the United States as far north as New York, and at least two crossed over to Europe and North Africa. Of the turtles released in Texas (4,794 from all six year-classes), 208 (95.8 percent) were recovered from the Gulf of Mexico (Table 6). Of the 197 turtles of the 1980 year-class released off Mexico, four (80.0 percent) were recovered in the Gulf of Mexico, but one was recovered in New York (Table 7).

The wide dispersal of head started Kemp's ridleys also can be discerned by comparing same day recoveries. For instance, two turtles were recaptured on June 15, 1983, one from the 1979 year-class at Core Sound, N.C. and the other from the 1981 year-class within the Galveston Bay near Texas City, Tex. On June 4, 1981, a turtle from the 1980 year-class was recovered at Galveston and another from the 1978 year-class was recovered at Bradley Beach, N.J. On November 1, 1981, a turtle from the 1980 year-class that had been released in the Bay of Campeche was recaptured at Morgan City, La., while another from the 1980 year-class that had been released off Padre Island was recovered south of Tampico, Mexico. On November 20, 1982, a turtle from the 1979 year-class that had been at large for 893 days was recaptured in a lagoon near El Jadida, Morocco, another from the 1980 year-class that had been at large for 536 days was found stranded on the beach at Panacea, Fla., and a third from the 1981 year-class that had been at large for 171 days was recovered at South Pass, Ala.

Table 2. Summary of releases of head started Kemp's ridley sea turtles by year-class[a].

Year-class	Number of live hatchlings received	Number of tagged turtles released	Percent released[b]	Number of tagged turtles recovered[a]	Percentage recovered
1978	3,080	2,019	65.6	76	3.8
1979	1,843	1,345	73.0	21	1.6
1980	1,815	1,723	94.9	86	5.0
1981	1,864	1,639	87.9	50	3.0
1982	1,524	1,325	86.9	155	11.7
1983	250	190	76.0	11	5.8
Combined	10,376	8,241	79.4	399	4.8

[a] As of September 30, 1985, with no exclusions.
[b] Based on number of hatchlings received alive.

Table 3. Numbers of head started Kemp's ridley sea turtles of the 1978-1983 year-classes recovered live, dead or in unknown condition[a].

Year-class	Condition	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Total	Percentage by condition
1978	Live	5	27	19	9	60	83.3
	Dead	0	3	5	1	9	12.5
	Unknown	0	3	0	0	3	4.2
	Total	5	33	24	10	72	
	Percentage by season	6.9	45.8	33.3	14.0		
1979	Live	0	5	4	5	14	70.0
	Dead	0	1	1	1	3	15.0
	Unknown	0	0	1	2	3	15.0
	Total	0	7	6	8	22	
	Percentage by season		30.0	30.0	40.0		
1980	Live	4	20	18	6	48	57.1
	Dead	0	4	4	7	15	17.9
	Unknown	0	9	7	5	21	25.0
	Total	4	33	29	18	84	
	Percentage by season	4.8	39.3	34.5	21.4		
1981	Live	2	14	7	4	27	54.0
	Dead	3	8	4	3	18	36.0
	Unknown	1	1	3	0	5	10.0
	Total	6	23	14	7	50	
	Percentage by season	12.0	46.0	28.0	14.0		
1982	Live	3	21	10	1	35	44.9
	Dead	2	13	15	0	30	38.5
	Unknown	1	5	4	3	13	16.6
	Total	6	39	29	4	78	
	Percentage by season	7.7	50.0	37.2	5.1		
1983	Live	0	3	2	0	5	71.4
	Dead	0	2	0	0	2	28.6
	Unknown	0	0	0	0	0	0
	Total	0	5	2	0	7	
	Percentage by season	0	71.4	28.6	0		
Combined							
	Live	14	90	60	25	189	60.8
	Dead	5	31	29	12	77	24.8
	Unknown	2	18	15	10	45	14.4
	Total	21	139	104	47	311	
	Percentage by season	6.8	44.7	33.4	15.1		

[a] As of September 30,1985, and excluding all recoveries that occurred 10 days or less after release.

Table 4. Geographical distribution of recoveries of head started Kemp's ridley sea turtles of the 1978-1983 year-classes[a].

State or Country	Year-Class 1978	1979	1980	1981	1982	1983	Total
Mexico			3	2			5
Texas	4	2	54	21	69	5	154
Louisiana	3		17	18	9	2	49
Mississippi	1	1	2	1			5
Alabama	1			3			4
Florida	25	13	2	3			43
Georgia	6		2	1			9
S. Carolina	9	1	1	1			12
N. Carolina	17	1	1				19
Virginia	2						2
Maryland	2						2
New Jersey	1	1					2
New York	1		1				2
France		1					1
Morocco		1					1
Unknown			1[b]				1
Total	**72**	**20**	**84**	**50**	**78**	**7**	311

[a] As of September 30, 1985, and excluding all recoveries that occurred 10 days or less after release.
[b] An indefinite LORAN reading was the only recapture location reported for this turtle from the 1980 year-class; therefore it could not be assigned geographically.

Table 6. Relationship between recovery location (state or country) and days at large for head started Kemp's ridley sea turtles of the 1978-1983 year-classes released in Texas[a].

Days at Large	State or Country Mexico	Tex.	La.	Miss.	Ala.	Fla. (Gulf)	Fla. (Atl.)	Ga.	S.C.	N.C.	NR[b]	Total
11-49		40	2								1	43
50-99		14	1									15
100-149	1	11	1			1						14
150-199	2	3	3		1	1						10
200-249		2			1							3
250-299	1	7	2									10
300-349	1	16	9	1	1							28
350-399		26	13	1								40
400-449		10	3	1				2				16
450-499		11	3						1			15
500-549		1	3			1			1	1		7
550-599		1					1					2
600-649			1									1
650-699		1	1									2
700-749		4					1	1				6
750-799		1										1
800-849		1										1
1150-1199			1									1
1200-1249		2										2
Total	**5**	**151**	**43**	**3**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	217

[a] See Table 1 regarding releases; recoveries as of Sept. 30, 1985, excluding all recoveries that occurred within 10 days or less after release.
[b] Not reported

Table 5. Relationship between recovery location (state or country) and days at large for head started Kemp's ridley sea turtles of the 1978 and 1979 year-classes relased in Florida.*

Days at large	State or Country of Recovery												
	Tex.	La.	Miss.	Ala.	Fla. Gulf	Fla. Atlantic	Ga.	S.C.	N.C.	Va.	Md.	N.J.	N.Y.	France	Morocco	Total
31-49	1				5	12										18
50-99			1		1	7										9
100-149					1	1										2
150-199					1	3										4
200-249					1		2									3
300-349	1				1											2
350-399		2				1		2	1							6
400-449		1		1	1	1		1		1		1				8
450-499					1	1	3									9
500-549												1				6
550-599													1			1
600-649														1		1
700-749								1								1
750-799			1					2		1						6
800-849							1	1			1					4
850-899								1							1	4
950-999								1								1
1100-1149																1
1200-1249																1
1500-1549																1
1550-1599								1								1
Total	2	3	2	1	12	26	6	10	1	1	2	2	1	1	1	89

*See Table 1 regarding releases; recoveries as of Sept. 30, 1985, excluding all recoveries that occurredin 10 days or less after release.

Table 7. Relationship between recovery location (state or country) and days at large for head started Kemp's ridley sea turtles of the 1980 year-class released in Mexico*.

Days at large	State or Country of Recovery				
	Mexico	Texas	Louisiana	New York	Total
50-99			2		2
200-249			1		1
500-549		1		1	2
550-599					
Total		**1**	**3**	**1**	**5**

*See Table 1 regarding releases; recoveries as of September 30, 1985, excluding all recoveries that occurred in 10 days or less after release.

Geographical distribution of recoveries of head started turtles was compared with that of stranded Kemp's ridleys in Figure 1. The stranding data were obtained from monthly reports published by the Sea Turtle Stranding and Salvage Network (STSSN), NMFS Southeast Fisheries Center, Miami Laboratory. The stranding data in Figure 1 do not include strandings of head started turtles. In general, the pattern of geographical distribution of Kemp's ridley recoveries and that of strandings appears to be similar, with some departure for Louisiana, Florida, Virginia and Massachusetts. Only those states in which both recoveries of head started Kemp's ridleys and strandings of Kemp's ridleys had been reported were included in this comparison, although the other states in the geographic series are shown in Figure 1. Monthly frequency distributions of recoveries and strandings also were similar (Figure 2). Strandings from Massachusetts in November and December of 1981 and 1982 were excluded from this comparison because we believed at the time of writing this paper in 1985 that the sporadic occurrence of Kemp's ridley there represented aberrant behavior. Similarities in distributions of strandings and recoveries suggest the head started turtles successfully integrate themselves into the natural Kemp's ridley population after release.

When recoveries are viewed with respect to the relationships among release area (Table 1), state or country of recovery (Table 4) and days at large (grouped by 50-day intervals), interesting patterns emerge (Tables 5-7). As one might expect, dispersion widened as days at large increased. There also was an annual resurgence of recoveries (Tables 5-7), probably reflecting a seasonal phenomenon related to behavior of the turtles, seasonal fishing activity, or recreational pursuits that bring people to the coasts.

The Florida releases (Table 1) produced recoveries with the widest dispersion and greatest days at large (Table 5), as these were the oldest turtles of all year-classes. Escapement from the Gulf of Mexico to the Atlantic Ocean characterized the Florida releases, whereas the Texas and Mexico releases were characterized by a predominance of recoveries within the western Gulf of Mexico (Tables 5-7). These results became the primary rationale for discontinuation of Florida releases after the first two years of head starting in favor of releases off Padre and Mustang Islands, Tex., in hopes that the turtles would remain and mature in the Gulf of Mexico. Florida releases had been urged by some turtle biologists in the early years, because turtles of yearling size are known to have been abundant in Florida waters in the past.

Seasonal Distribution

Recoveries showed a definite seasonality (Table 3). This may be related to seasonality in commercial and sports fishing activities, environmental conditions and recreational activities along beach fronts, or a combination of these variables.

Recoveries by Year-Class

1978 Year-Class

The release and subsequent recovery of the 1978 year-class has been discussed by McVey and Wibbels (1984). Because turtles from this year-class have been at large the longest time, we examined recoveries from this year-class in greatest detail. Most (1,906 turtles, or 94 percent) of the turtles released from this year-class were released in the Gulf of Mexico off Florida (Table 1) because this area had been identified as a typical habitat of juvenile Kemp's ridleys. Of the 76 recoveries from this year-class, 57 (75 percent) were made on the Atlantic coast of the United States. As of September 30, 1985, the latest recovery from this year-class had occurred on August 18, 1983 at Hunting Island, S.C., and the turtle was alive and released. This turtle had been released into the Gulf of Mexico on May 8, 1979 at Homosassa, Fla., and had been at large for 1,563 days. Unfortunately, no lengths or weights were reported.

Recoveries of the 1978 year-class, as with other year-classes, evidently were seasonal, with most recoveries reported

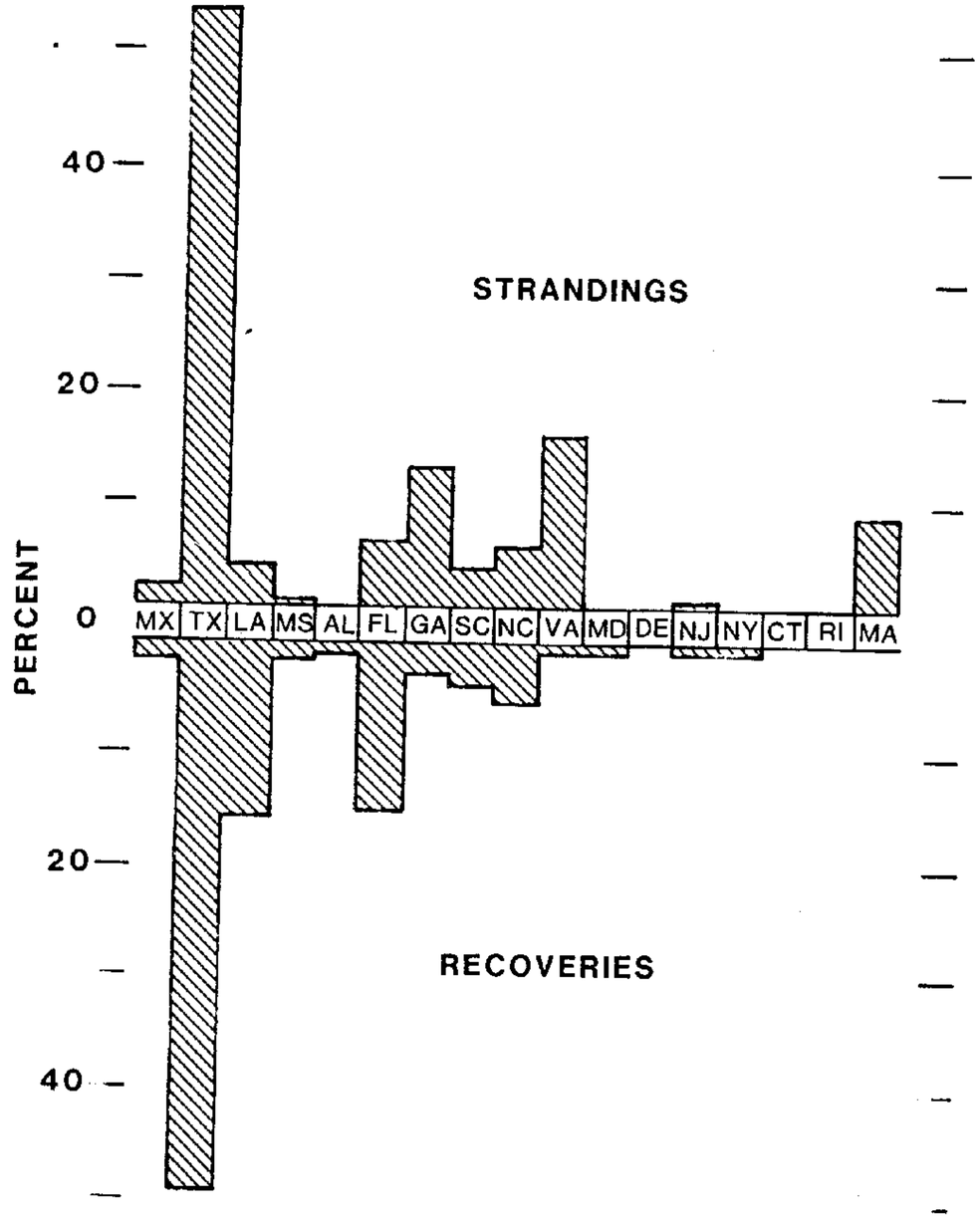

Figure 1. Comparison of geographic distributions of recoveries of head started Kemp's ridley sea turtles and Kemp's ridley strandings (data from the Sea Turtle Stranding and Salvage Network) during calender years 1979-1984.

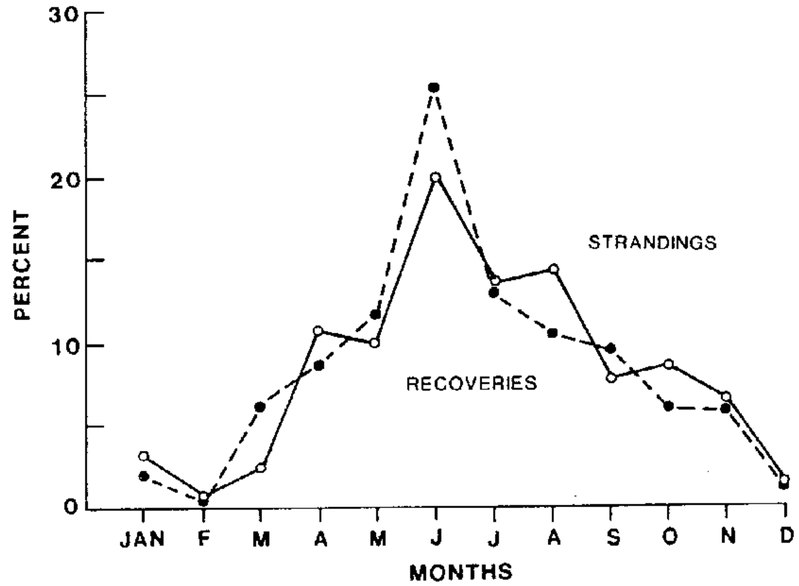

Figure 2. Comparison of monthly distributions of recoveries of head started Kemp's ridley sea turtles and Kemp's ridley strandings (data from the Sea Turtle Stranding and Salvage Network) during calender years 1979-1984.

during warm months (Table 3, Figure 3). The paucity of reported recoveries during the cold months may be linked to reduced commercial and recreational fishing and other outdoor activities, as well as possible seasonal movements of sea turtles.

Annual recoveries from the 1978 and other year-classes declined from year to year as would be expected due to mortality, but the decline could also have reflected tag loss (Figure 3). Observations on tagged turtles at private marine aquaria (Larry Ogren, NMFS, SEFC, Panama City, Fla., personal communication, October 1985) and from metal flipper tag loss studies (Henwood, 1986) on loggerhead sea turtles (*Caretta caretta*) indicate high rates of tag loss during the first two years after tagging. Such loss of flipper tags may be due to one or a combination of factors: (1) improper initial application of the tag, (2) deterioration of the tag from the corrosive action of seawater, and (3) tag sloughing due to rapid growth of the turtle in relation to size of the tag, infection leading to necrosis, or both. Nevertheless, two recoveries of the 1978 year-class were reported in 1983, five years after release (Figure 3), so the metal tags can be retained in some cases.

During 1979, turtles of the 1978 year-class were recovered only in Florida and only during the first three quarters of the year. Few recoveries were reported from October 1979 through March 1980, then in spring (April-June) and summer (July-September) of 1980 the number of recoveries increased, particularly along the east coast of the United States. Three recoveries were reported from North Carolina during winter (October-December) 1980, and none during spring (January-March) 1981. Turtles of the 1978 year-class reappeared from Georgia to New Jersey during summer-fall 1981, a period of 768 to 950 days after release and following two winters at large. Only one recovery from the 1978 year-class was reported during 1982. One recovery was reported from South Carolina in 1983 after three winters at large.

Five turtles from the 1978 year-class were recovered more than once. One (tag G0104) was recovered along the U.S east coast on three different occasions after its release on February 22, 1979, at Sandy Key, Fla., at a weight of 0.7 kg. It was recovered 47 days later on April 10 near Miami, Fla., and weighed 0.6 kg, 0.1 kg less than at release. The turtle was in good condition and was re-released on the same day. It next appeared 730 days later on April 9, 1981 near Ocean City, Md. It again appeared in good health and was re-released on the same day (no weight or measurements were taken). The turtle was recovered a third time 56 days later on June 4, 1981 at Bradley Beach, N.J. At that time it was reported to weigh 4.5 kg, and was released on the same day. This turtle traveled from Sandy Key, Fla., to Bradley Beach, N.J., over an 833 day sojourn spanning two winters.

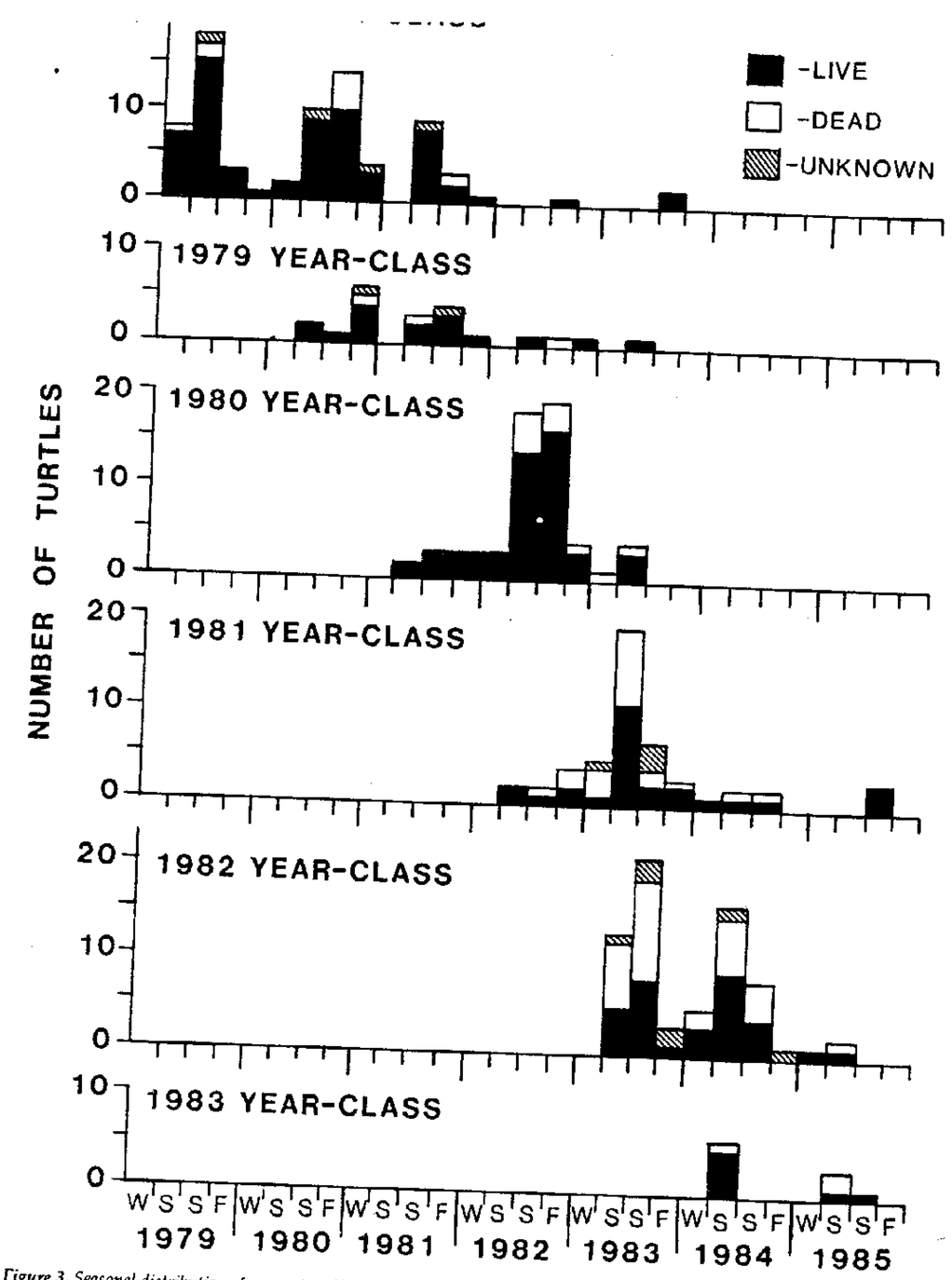

Figure 3. Seasonal distribution of recoveries of head started Kemp's ridley sea turtles, by year-class and calender year of recovery.

Four turtles of the 1978 year-class were recovered twice. One (tag G0460) was recovered first on September 25, 1979, 209 days after release at Jekyll Island, Ga., and was released; 26 days later it was recovered at the same location and weighed 3.9 kg. Another (tag G0904) was recovered on August 25, 1980, 475 days after release, at Colonel Island, Ga. It was re-released and recovered again 14 days later at the same location on September 8, 1980. The turtle was re-released in good condition, but no measurements or weight were taken. A third turtle (tag G2385) was recovered on April 4, 1980, 352 days after release, at Holly Beach, La. It was re-released and again recovered 59 days later on June 22, 1980 at Johnson Bayou, La., at which time it weighed 2.7 kg. On September 2, 1981, the fourth turtle (tag G2830) was recovered at Edisto Beach, S.C., 848 days after release. After re-release on the same day, it was found dead 20 days later on September 22 on the same beach and in the same location. It weighed 4.5 kg when found dead. From the time of its release on May 8, 1979 until it was found dead, this turtle had survived two winters.

1979 Year-Class

As of September 30, 1985, 21 (1.6 percent) recoveries had been reported from the 1979 year-class. One recovery (tag K1773) was from a turtle held into its second year in captivity before being released in 1981 with the 1980 year-class offshore of Padre Island, Tex. By September 30, 1985, the most recently recovered turtle (tag NNA001) from the 1979 year-class was recovered alive and re-released at Core Sound, N.C. on June 15, 1983. It originally had been released offshore of Homosassa, Fla., on June 5, 1980.

Two of the most interesting recoveries of head started Kemp's ridleys were from the 1979 year-class. One (tag NNN893) released offshore of Homosassa, Fla., on June 5, 1980 was recovered 568 days later at Biarritz, France on December 25, 1981 (Wibbels, 1983). It weighed 2.0 kg at the time of recovery. Another (tag NNN678) released with the first was recovered 893 days later on November 20, 1982 at El Jadido, Morocco. This turtle was found in a lagoon, wrapped in a fisherman's net, and was measured before being released. The turtle reportedly weighed 20 kilograms, and was the largest of all head started Kemp's ridley reported as of September 30, 1985.

1980 Year-Class

Included among the head started turtles released from the 1980 year-class were 197 that had been imprinted as hatchlings on the Rancho Nuevo beach. They were released in the Bay of Campeche near Arrecife Alacran, Mexico, on March 3, 1981, from the NOAA research vessel *Oregon II*. From this Bay of Campeche release, five (2.5 percent) recoveries had been reported, as of September 1985 (Table 7). Two were reported from Louisiana, within 99 days after release (Table 7). Between 200 to 249 days at large, onr more was recovered from Louisiana. The last two from this group were recovered 500 to 599 days after release; one of these was recovered at Fire Island, N.Y. on August 14, 1982.

Of the turtles released from the 1980 year-class, 1,526 (88.6 percent) were released offshore of Padre Island on June 2, 1981. All but two of the recoveries reported from this release were made in the Gulf of Mexico. One of the exceptions (tag K1495) was recovered alive at Ossabow Island, Ga. on August 19, 1982, 443 days after release, and it was re-released on the same day. The other (tag K1625) was recovered alive at Hunting Island, South Carolina on September 9, 1982 and was re-released on the same day.

The preponderance of recoveries from the 1980 year-class have been made in Texas and Louisiana (Table 4), although a few migrated to the south and east. The single most frequent number of recoveries (12) taken in one location from this year-class was near Matagorda, Tex., approximately 161 kilometers east of the release site, between 43 and 454 days after release.

1981 Year-Class

The 50 (3.0 percent of those released) reported recoveries from the 1981 year-class were made from the northeast coast of Mexico to South Carolina, but the majority of these, 39 (78.0 percent of the recoveries), were made in Texas and Louisiana (Table 4).

1982 Year-Class

Most turtles (1,159 turtles or 87.5 percent of those released) of the 1982 year-class were released offshore of Padre and Mustang Islands into drifting sargassum weed patches, with the intent of providing them with cover and an immediate food supply (Carr, 1986). However, within 10 days of release, 77 of these turtles had been found stranded on beaches within 32 kilometers of the release site. All showed evidence of contact with oil to varying degrees, and 20 were found dead. All of the dead turtles examined appeared to have ingested tar or crude oil. The 56 turtles found alive were cleansed of oil and rehabilitated, either at the Padre Island National Seashore or The University of Texas Marine Science Institute, Port Aransas, Texas. They were subsequently released offshore of Mustang Island by Anthony Amos. None of the 77 turtles stranded within 10 days of release were included in our data summaries.

Out of the total of 1,159 Kemp's ridleys released from the 1982 year-class off Padre and Mustang Islands on June 7, 1983, 24 were recovered from the Corpus Christi Bay area, one from Galveston Bay and one from Brownsville, Tex. Two of the turtles from this offshore release were recovered virtually at the exact site of the inshore release within

Nueces Bay (Table 1), one at 20 and the other at 28 days after release offshore. This suggests a selection of inshore habitat by head started Kemp's ridleys.

Seasonal distribution of recoveries of the 1982 year-class shown in Figure 3 is much like that of other year-classes. Recoveries of head started turtles from the 1982 year-class began to be reported on the western Gulf coast in March 1984 and reporting continued through the warm months of that year. This year-class was foremost among the year-classes for which reported recoveries were confined almost entirely to the western Gulf of Mexico (Table 4).

1983 Year-Class

There was a poor hatch (12 percent) in the 1983 year-class at the Padre Island National Seashore. Only 250 hatchlings that had been imprinted at Rancho Nuevo were received for head starting.

Within 10 days of the release of 190 tagged survivors on June 5, 1984, four recoveries were made. From that time to September 30, 1985, seven more recoveries were reported from the 1983 year-class (Table 4).

Growth

Growth in weight (g) was examined in head started Kemp's ridleys that were recovered after release. When carapace length but not weight was reported, the following weight-length equation from McVey *et al.* (manuscript), based on 5,064 pairs of weight and length from head started turtles ranging in size from hatchlings to 20.0 kilograms in weight, was used to estimate weights from lengths:

$$W = 0.2301\ (L^{2.992})$$

where

W = weight in grams
L = straight line carapace length in centimeters

Weights of recovered turtles are plotted against years at large (Figure 4), for two different groupings of points, one for turtles recovered in the Gulf of Mexico and the other for turtles recovered in the Atlantic Ocean. Separate exponential growth curves, one for the Gulf and the other for the Atlantic, were fitted to the data points using the following model (in logarithmic form):

$$\ln W = \ln a + bt,$$

where

W = weight in grams,
t = years at large, and
a and b are estimated parameters.

The exponential curves derived therefrom are shown in Figure 4. The slopes, b, were significantly different ($P<0.05$), and growth rate was greater in the Gulf of Mexico than in the Atlantic.

Growth in weight of captive-reared Kemp's ridleys over a six-year period at Sea-Arama Marineworld in Galveston was examined by Caillouet *et al.* (1986), and the fitted growth curve for the captive-reared turtles is drawn in Figure 4 for comparisons with curves fitted to recapture weights. Growth in captivity was more rapid than growth of head started turtles released into the wild.

Growth in turtles from different year-classes could not be validly compared because it was confounded with the effects of location (Gulf of Mexico vs. Atlantic Ocean) and because the growth histories of the different year-classes spanned different years (Figure 3).

Condition of turtles and location and method of recovery information on whether or not the animal was alive or dead at recovery was lacking in some cases, but the majority were reported to have been found alive and released (Table 3).

Recovery location of head started turtles was 54.0 percent offshore and 46.0 percent inshore, despite the fact that 98.8 percent of the turtles were released in waters seaward of the barrier islands. Only the 96 turtles released in Nueces Bay represented an inshore release (Table 1). This suggests that the turtles seek out the inshore environment, even when released offshore. The dominant methods of recovery were unknown (33.1 percent), shrimp trawl (28.9 percent), stranded dead (15.1 percent) and stranded alive (10.4 percent) (Table 8).

Percentage recovery (Table 2) probably reflects some tag loss. Also, all recoveries are not reported, and reporting rates for recoveries are not constant, either spatially and temporally, or among year-classes. We had no information to test the various effects on recovery rates. In some cases (e.g, 1982 year-class) the recovery was high (11.2 percent) because of oiling of the turtles shortly after their release. Thus, we can consider the observed recoveries to represent an underestimate for head started Kemp's ridleys released into the wild. Figure 3 depicts seasonal variation in recoveries as well as the year to year decline in recoveries.

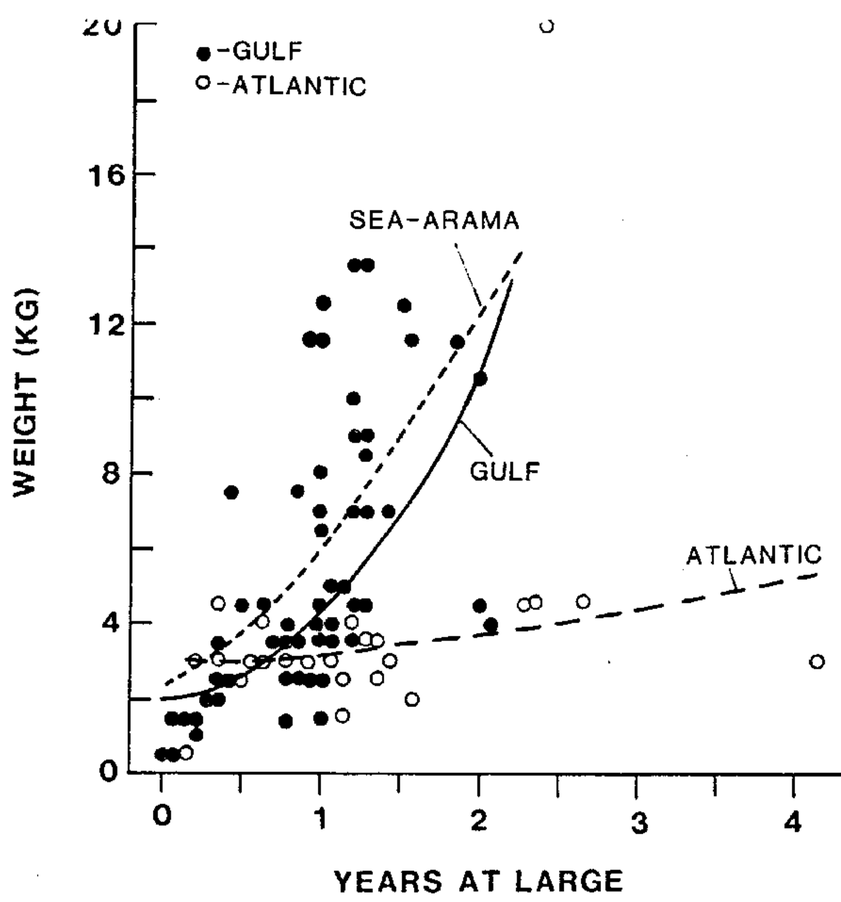

Figure 4. Scatter diagram and fitted exponential relationships between recapture weight and years at large for head started Kemp's ridley sea turtles recaptured in the Gulf of Mexico (dots and solid line) and Atlantic Ocean (circles and dashed line) as compared to growth curve for Kemp's ridleys in captivity (small short-dashed line) at Sea-Arama Marineworld, Galveston, Tex.

Discussion

Carr and Caldwell (1958) suggested that Kemp's ridley may be endemic to the Gulf of Mexico, and that records of its occurrence on the Atlantic coasts of North America and Europe are based on stragglers lost to the Gulf via the Florida current and Gulf Stream. Two major forage grounds for mature Kemp's ridleys have been identified, one in Campeche, Mexico and the other off western Louisiana (Chávez, 1968; Pritchard and Márquez, 1973). In Massachusetts waters, Kemp's ridley appears to be more common than the loggerhead, and this also seems to be the case in Nova Scotia (Dodge, 1944; Bleakney, 1965). In Virginia (Musick, 1979), most ridleys were small (<18 kg). Lazell (1976) suggested that Kemp's ridley's occurrence off New England may be cyclic and that this may be true for Virginia as well.

Carr (1963, p. 300) stated: "It is possible, for example, that the European ridley records represent waifs permanently lost to the breeding population." Carr (1967), apparently reconsidering the possibility of a nesting location south of European Atlantic waters, stated that: "no ridley of any kind is known from Morocco, Spanish Sahara, and the Canary and Cape Verde Islands, or from anywhere in the open ocean from Mauritania up to Azores." Later, Brongersma (1972) stated that: "Kemp's ridley has not been found in the southern area of France but has been recorded from Ireland, Scotland, England, Wales, Channel Islands, the Netherlands, Azores, and Madeira." All specimens from European waters have been classified as being young to about half grown. A specimen recorded from the Azores in

Table 8. Summary of recovery location, method, tag status, and turtle condition for head started Kemp's ridley sea turtles from year-classes 1978-1983*.

	Year-class						
	1978	1979	1980	1981	1982	1983	Combined
Recovery Location							
Offshore							
Beach	9	1	11	10	43	2	76
Surf	0	1	2	1	2	2	8
Open Water	16	5	21	15	7	1	65
Other	4	1	0	2	2	0	9
Unknown	2	1	5	2	0	0	10
Inshore							
Beach	5	3	3	2	5	1	19
Surf	2	1	2	2	0	0	7
Open Water	10	0	15	5	0	0	30
Other	16	3	7	6	13	1	46
Unknown	8	4	18	5	6	0	41
Method of Recovery							
Shrimp trawl	13	1	34	24	16	2	90
Gill net	7	0	0	1	3	0	11
By hand	2	0	0	0	0	0	2
Hook and line	3	1	10	1	2	1	18
Stranded dead	5	3	10	7	20	2	47
Stranded alive	7	7	5	2	7	4	32
Unknown	35	8	26	14	20	0	103
Other	3	1	1	1	1	1	8
Tag Status*							
Tag left on turtle	51	14	44	25	38	6	178
Tag removed/alive	11	1	12	3	5	1	33
Tag removed/dead	0	0	4	8	10	3	25
Double tags	0	0	0	0	25	0	25
Unknown	13	6	26	14	16	0	75

*The listed categories are not always mutually exclusive.

1939 was estimated to be 4 months old. Mowbrag and Caldwell (1958) referred to a Kemp's ridley from Bermuda that was captured on March 31, 1949, and weighed 6.8 kilograms. However, its species identification is in doubt (Pritchard, 1969).

Brongersma (1972) stated that: *"L. kempi* breeds in the Gulf of Mexico and, as far as we know, only there. All specimens found along the North America east coast, in European Atlantic waters, in the Azores and off Madeira must have come from the Gulf of Mexico. The fact that in American Atlantic coastal waters *L. kempi* seems to be more common than *C. caretta* may perhaps be explained by *C. caretta* being a more oceanic species, the young of which at a very early age already move out into the open ocean, while *L. kempi* tends to keep to shallower water, closer to the coast. This may be one of the reasons too that fewer Kemp's ridleys than loggerheads reach European Atlantic waters. Another reason may be that the nesting beaches of *L. kempi* are further away from Europe."

On the basis of data from tagging, shrimp trawler catches, and extensive observations, Hildebrand (1982) suggested that the entire life cycle of Kemp's ridley may be completed within the Gulf of Mexico. Carr (1980) also thought this to be a definite possibility but also that it was probable that the entire population was not so contained. Small ridleys occur frequently on the coast of New England (Lazell, 1979) and Virginia (Lutcavage and Musick, 1985) which might represent a regular station in the developmental ecology of a part of the species. Carr (1980) and Witham (1980) both believed that the warm waters of the Gulf Stream supplied the northern waters with ridleys regardless of whether the young turtles emerged from the current farther south and swam north, or were transported into New England coastal waters by local eddies of, or separated from, the Gulf Stream. Unless the northern ones are lost to the population they must swim to Florida under their own motivation and efforts. Carr (1980) theorized: "The alternative possibility, that

they never go back at all, that all post-Florida ridleys may be lost waifs, is reinforced by the occurrence in European waters of juveniles even smaller than the average for the U.S. Atlantic coast. Most European specimens range in shell length from 10 to 25 cm, and they are derived from Old World nesting grounds, but *L. kempi* has none there." Carr (1980) further reinforced his belief that the Atlantic Kemp's ridleys are lost waifs never to return to the Gulf of Mexico, and concluded that if the life cycle of the Kemp's ridley is completed within the Gulf of Mexico, then "the lost year puzzle is confirmed as the most substantial of all obstacles to understanding the ecology of sea turtles." However, Carr (1986) relaxed his position regarding the lost year hypothesis after recognizing an association between juvenile sea turtles, sargassum weed and oceanic convergence zones.

Witham (1976) argued strongly for ocean current transport of young sea turtles and suggested that such currents might also be important to adult sea turtle dispersal. It has been estimated (Hughes, 1974) that hatchling sea turtles entering the sea at a Caribbean site would require four to seven years to circumnavigate the North Atlantic and return to their natal beach. On the other hand, Witham (1976) and Witham and Futch (1977) indicated that such circumnavigation could take less than one year in the North Atlantic gyre, which includes the Florida Current and Gulf Stream.

Obviously, not everyone agreed with Carr's (1955) "lost waif" theory. Pritchard and Márquez (1973) postulated that most of these young ridleys that leave the Rancho Nuevo nesting beach and are carried around the Gulf of Mexico to the Florida Keys then up the U.S. east coast as far as Canada eventually migrate back to the Gulf of Mexico to Rancho Nuevo to reproduce, even though a few are carried by the Gulf Stream to European waters. Lazell (1980) stated that "New England's sizable aggregations of marine turtles have been known to be regular, healthy migrants, rather than waifs, in New England waters since Bleakney (1965) first called attention to their robust, aggressive, and good condition." At the time Carr (1975) wrote his paper the greatest concentration of positively identified Kemp's ridleys that he had heard of, other than that at the nesting beach at Rancho Nuevo, occurred in Martha's Vinyard, Mass. Lazell (1976) noted that *L. kempi* was a regular migrant to Massachusetts waters, and Lazell (1980) wrote: "The vast majority of ridleys seen by me in New England waters were active, healthy, and fed voraciously at ambient water temperatures. The evidence available for the natural, normal, and regular presence of ridleys in summer and autumn is inferential, of course. The alternative is to believe the ridleys come here to die, or perhaps hibernate. Records for Kemp's ridleys in the Gulf of Maine region are substantial. With eight salvaged in 1978 alone, the weight of evidence argues well for these waters as a critical habitat for this desperately endangered species. It is now incumbent upon those who disagree with my interpretation of the data to muster some contrary evidence." Shoop (1980) further reinforced the idea that New England waters are potential developmental habitat by stating that: "Each year several juvenile ridleys wash up on the shore of Cape Cod Bay, apparently drowned after becoming too cold. Perhaps they are trapped in the geographical hook of the Cape as they try to migrate southward. Our guess is that the small ridleys are pushed northward in the Gulf Stream, from which they make their way to shallow bays, sounds, and estuaries where they feed on mussels and other invertebrates and then move south, perhaps maturing in the Gulf of Mexico and never returning to northern waters."

Chesapeake Bay is a seasonal foraging area for juvenile loggerheads (*Caretta caretta*) and Kemp's ridleys (Byles, 1982; Lutcavage and Musick, 1985). Stranding and sighting reports documented by Lutcavage (1981) indicated that both species are present in the bay from April through November and disappear with the advent of cold weather. Byles (1982) observed: "The turtles in the Chesapeake Bay and along the Virginia coast cannot survive the cold winter temperatures and so must either migrate to warmer waters or overwinter submerged in the sediment. The latter method of survival seems unlikely due to penetration of cold water (1-5° C) to the bottom over most of the bay and nearshore shelf."

A decline in turtle abundance during winter was apparent in the turtle fishery in West Florida (Fritts *et al.*, 1983). It was suggested that the turtles bury themselves in the mud and become dormant in the winter (Carr and Caldwell, 1956; Pritchard and Márquez, 1973). Winter dormacy of Kemp's ridleys was evident when turtles were found with mud on their backs (Ehrhart, 1980; Carr, Ogren and McVea, 1980). Kemp's ridleys have been found with loggerhead turtles in an apparent state of winter dormancy in water of 11°C in Florida (Carr *et al.*, 1980; Ogren and McVea, 1982). Dormant periods in the mud may be an adaptive response to avoid cold shock. In water temperatures of 10°C or less, ridleys become stunned and float immobile at the surface (Ehrhart, 1980; Schwartz, 1978). Ridley turtles died within 24 hours during exposure to water temperatures of 5-6°C (Schwartz, 1978). No evidence has been found of sea turtles wintering in Virginia waters (Musick *et al.*, 1983; Lutcavage and Musick, 1985).

Chesapeake Bay Kemp's ridleys are all small immatures, most being between 30 and 45 cm. Beginning in 1979, 47 ridleys were documented in Chesapeake Bay, 30 dead and 17 alive, and none between November and May (Musick *et al.*, 1983). One was a head started turtle (tag G0080) released at Homosassa, Fla., on February 22, 1979. It had traveled 2,277 kilometers, moving at an average of 5.3 kilometers per day, to Hampton Roads, Va. where it was captured alive after approximately 14 months at large (Musick *et al.*, 1983).

Of the three ridleys reported from the Indian River, Fla., (Ehrhart, 1983), two were only slightly shorter than the

smallest adult females reported by Pritchard (1969), and the third was well within the size range of adults. According to Ehrhart (1983) it seemed unlikely that these individuals could have returned to Rancho Nuevo to breed by the following spring, but a later return to the natal beach was neither suggested nor denied.

During the first Western Atlantic Turtle Symposium in San Jose, Costa Rica, in 1983, the following comment was made to the panel of sea turtle experts by Dr. C. R. Shoop (Márquez, 1983): "Since most Kemp's ridley strandings in the U.S. are along the Atlantic Coast, does the panel actually believe all of the animals are waifs? The number of juveniles along the eastern U.S. is substantial, almost all are very healthy, and the observations have been made every year. Surely, some emphasis in research on these eastern U.S. animals is in order." The discussion panel's response (Márquez, 1983) was that: "The panel does not have data to reach conclusions on the question of Kemp's ridleys on the Atlantic coast. Are they, or are they not waifs? Research is in order." A statement made by Musick *et al.*, (1983) emphasized: "Since there is a great difference in habitat preference and feeding habit (between the various sea turtles), planning should address the individual species rather than sea turtles as a general category."

The number of head started Kemp's ridleys found on the east coast of the United States is not surprising when compared to the distribution shown by the literature we reviewed and by records from the Sea Turtle Stranding and Salvage Network. Multiple recoveries of some head started turtles raise a number of questions. For instance, one head started Kemp's ridley (tag G0045) was recovered on November 25, 1980, at Core Sound, N.C. after 642 days at large. The turtle was alive and was released in good condition. It was recovered again at Core Sound 208 days later on June 21, 1981. What happened to this turtle during the winter of 1980-1981? Did it migrate to warmer waters before winter, then return to the same area when waters warmed, or did it overwinter at Core Sound? Another (tag G0104) was recovered and released on three different occasions, the first at Miami, Fla., on April 9, 1979, the second at Ocean City, Md., on April 9, 1981, and the third at Bradley Beach, N.J. on June 4, 1981. Where was this turtle during the winters of 1979-1980 and 1980-1981? A third head started turtle (tag G0914) was recovered at Beaufort, N.C. on August 20, 1980, after 470 days at large. This turtle was recovered again 1,052 days later on July 9, 1983 at Hampstead Bay, N.C. Again, where was this turtle during the intervening four winters? It was recovered twice in the same general area and dates 1,052 days apart! The turtles may migrate to warmer areas when colder weather begins to occur in the fall and then return in the spring, or they could conceivably burrow into the mud of deep bays and sounds to overwinter. It is important to conservation of Kemp's ridley to determine whether one, the other, or both occur.

The head started turtle (tag NNN893) of the 1979 year-class recovered in Biarritz, France on December 25, 1981, had been at large 568 days, for one winter and a portion of another. This turtle was small (2.0 kg) and cold-stunned when found. However, the most interesting of all recoveries occurred at El Jadida, Morocco on November 20, 1982 after the turtle had been at large for 893 days. This turtle (tag code NNN678) had survived two winters, was alive and in excellent condition when captured in a fisherman's net in a lagoon, and was reported to have weighed 20 kg Unfortunately, the flipper tag was removed and sent with the recovery information to Miami.

Another head started turtle from the 1979 year-class, held in captivity at Cayman Turtle Farm (1983), Ltd., laid eggs there in the spring of 1984. This turtle also weighed 20 kg at the time (Wood and Wood, 1984). The Rancho Nuevo nesting beach is located at 23° 11'N latitude and 97° 46'W longitude. This latitude strikes the northwestern coast of Africa just south of Golfo de Cintra, Spanish Sahara (Figure 5), approximately 1,127 kilometers south of the lagoon where the head started turtle (tag NNN678) was recovered. Carr (1957) hypothesized an Old World colony of "five-scaled" ridleys (implying Kemp's ridley) on the northern coast of West Africa, and made a flight along the uninhabitated coast from Mauretania to Morocco in search of Kemp's ridleys, but to no avail. In his continuing commentary on Kemp's ridley nesting beaches during the 1950s, Carr (1957) observed that although this species was apparently absent from the Caribbean, there is some unexplored territory there, and it still seems possible that "part of the American Atlantic ridley population could be derived from West Africa – either from somewhere within the range of the form that lives about and below the bulge, and in the Gulf of Guinea and which has predominantly six lateral laminae, or from the long extent of shore from Port Etienne to Morocco, where nothing is known of the turtle fauna."

We suggest that the area from Port Etienne to Morroco should be reinvestigated as a possible nesting site for Kemp's ridley. Not only is this area near the same latitude as that of Rancho Nuevo, Mexico, but many of the nesting prerequisites listed by Pritchard (1969) for Kemp's ridley occur there; e.g., numerous, shallow, warm water lagoons. Similar habitat exists along the northern coast of West Africa, and the numerous islands of the Arquipelago de Madeira and the Islas Canarias could provide sanctuary for small turtles.

It is clear that young juvenile Kemp's ridley sea turtles can and do exit the Gulf of Mexico and escape into the Atlantic. There they possibly enter the Gulf Stream where they can become entrapped in eddies that spin off from the main current toward estuarine areas along the east coast of the United States (Carr, 1986). Our recovery data for head started Kemp's ridleys, the published distribution records, and strandings reported by the Sea Turtle Stranding and Salvage Network all show that Kemp's ridley is common to the east coast of the United States. We do not believe that

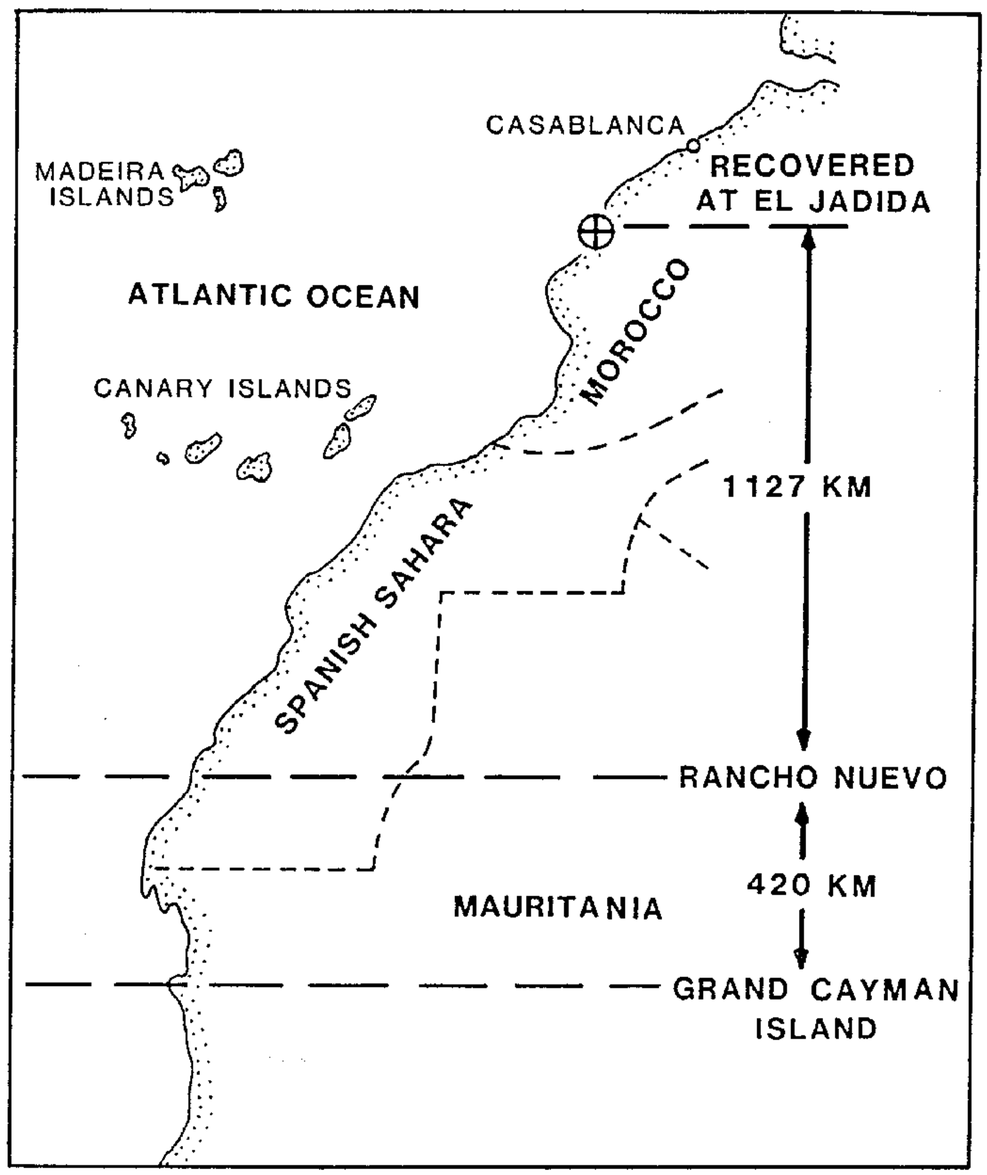

Figure 5. The northwest coast of Africa showing the northward location (latitude 33°4' N) of the recovery of a 1979 year-class head started Kemp's ridley sea turtle as compared to locations of the Rancho Nuevo nesting beach (latitude 23°11' N), Tamaulipas, Mexico, and the Cayman Turtle Farm (1983) Ltd. (latitude 19°3' N), Grand Cayman Island, B.W.I.

smaller Kemp's ridleys found on the Atlantic coast are "lost waifs," but that these east coast turtles represent an integral part of the life cycle of this species. Further, from previous records and ours we know that Kemp's ridley occurs in European waters, and one of our head started turtles has been reported from the northern coast of West Africa at a reported size comparable to one that matured and nested in captivity. Therefore, it is tempting to resurrect Carr's (1955) speculation of an Old World nesting site on the northern coast of West Africa. The search should continue.

Acknowledgements

This work was conducted under permits from Mexico's INP, the FWS and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It would not have been possible without the diligent and conscientious efforts of a number of agencies, organizations and individuals. Primary among these were: René Márquez, INP, Mexico; Jack Woody and Dave Bowman, FWS, Albuquerque, N.M.; Milford Fletcher, Jim Wood and Bob King, NPS, Santa Fe, N.M. and Padre Island National Seashore, Corpus Christi, Tex.; Edward Klima, Charles Caillouet, Jim McVey and Ray Wheeler, NMFS, Galveston, Tex.; Carole Allen, HEART (Help Endangered Animals - Ridley Turtles), Houston, Tex.; Herb Kumpf and Fred Berry, NMFS, Miami, Fla.; Pat Burchfield, Gladys Porter Zoo, Brownsville, Tex.; Anthony Amos, The University of Texas, Port Aransas; Peter Pritchard, Sea Turtle Recovery Team, Florida Audubon Society, Maitland, Fla.; and Larry Ogren, NMFS, Panama City, Fla.

Data management on recoveries of head started turtles was possible through the cooperative efforts of Bill Pringle and Barbara Schroeder, NMFS, Miami, Fla. and Dennis Koi, NMFS, Galveston, Tex. Many other individuals and organizations, too numerous to mention, have contributed to the success of the head start project at Galveston. To all of them, we owe a heart-felt and sincere thanks.

Marty Tyree and Dickie Revera assisted in data preparation and review of the manuscript. The figures were prepared by Danny Patlan and the original manuscript was typed by Beatrice Richardson.

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